PATENT APPLICATION

Version No. 2

Date 28 November 2003

Our Ref.: 16159-2US

as filed

Title: **MODULAR SYSTEM FOR BUILDING STRUCTURES**

Inventors: **MULAS, Francesco**
Woodbridge, Ontario, Canada
GUCCIARDI, Ciro
Woodbridge, Ontario, Canada

Applicants: **MULAS, Francesco**
Woodbridge, Ontario, Canada
GUCCIARDI, Ciro
Woodbridge, Ontario, Canada

OGILVY RENAULT

Barristers & Solicitors
Patent & Trade-mark Agents
200 King Street West, Suite 1100
Toronto, Ontario, Canada M5H 3T4
Tel: (416) 216- 3903 - Fax: (416) 977 5239
pfield@ogilvyrenault.com

MODULAR SYSTEM FOR BUILDING STRUCTURES

TECHNICAL FIELD

[0001] The invention relates to a modular system for construction of building structures such as walls, floors or concrete forms including modular panels and releasable interlocking keys.

BACKGROUND OF THE ART

[0002] In general, the invention relates to a modular assembly system for making concrete forms or other building wall structures, of a temporary or permanent nature. The basic component is a rectangular shaped body module formed from an aluminium extrusion cut in various standard lengths such as 4 feet, 8 feet, 12 feet, etc. A standard module may have a 12 inch width for example and be 3 ½ inches thick although other sizes and shapes can be easily provided by manufacturing extrusion dies accordingly. The module includes cylindrical grooves along its length which allow for interlocking between adjacent modules using an internally mounted figure-8 shaped key or externally mounted bracket with a wedge connector. The key and/or bracket connectors can join panel modules lengthwise and laterally. Other connectors and accessories may be provided for assembling various structures as described in detail herein.

[0003] The present invention relates to an innovative system, particularly useful in today's building industry,

in that provides a competitive edge in the market place in all the aspects of:

- construction materials (for structural and architectural applications)
- products (for conventional and reinforced concrete projects/applications)
- systems (for below-grade, above-grade, exterior, or interior applications)
- services (mostly related but not limited to the single-family-housing / building industry)

[0004] The present invention implies the use of a novel forming system, which is primarily intended to simplify and encourage the use of the concrete for all, and combination of:

- Site installed, as part of a generic building system, applications
- Site assembled, as a proprietary building system, applications
- Site manufactured where minimum semi-skilled labour and standard construction methods are used.

[0005] In the prior art, concrete poured works have been provided with limited sizes and ranges of forming panels, requiring extensive use of accessories for build ups and still of limited uses.

[0006] These earlier methods have the drawback that they cannot account for different construction variables without the burden of extensive field modifications. Moreover handling and erection of these earlier panels work is laborious and time consuming.

[0007] Further advantages of the invention will be apparent from review of the disclosure, drawings and description of the invention below.

DISCLOSURE OF THE INVENTION

[0008] The invention provides a modular assembly of a plurality of elongate modules with a uniform cross-section and at least one adjacent module engagement surface with an elongate groove extending the length of the module. Adjacent modules of the assembly are laterally linked together with their engagement surfaces abutting each other and connectors mounted in the grooves of each adjacent module spanning therebetween.

[0009] The modular assembly may comprise a composite panel system of extruded aluminium work. A forming building system wherein said concrete forming system is a re-usable, versatile, lightweight aluminum modular system for concrete work applications.

[00010] According to the present invention, there is a forming system comprising an exclusive combination of precision extruded units modularly connected by extruded key-joints and bracket connectors for an extensive variety of modifiable and re-usable applications of concrete forming work.

[00011] An important advantage afforded by the unique forming system of the present invention is that it can be employed for walls, floors and roofs on load bearing or non-load bearing applications with several inherent benefits further detailed herewith.

DESCRIPTION OF THE DRAWINGS

[00012] In order that the invention may be readily understood, embodiments of the invention are illustrated by way of example in the accompanying drawings.

[00013] Figure 1 shows a cross-sectional view through an elongate module or extruded aluminium panel of generally rectangular shape having four sides with a cylindrical groove together with a filler strip for the groove, a figure-8 shaped connector and a reveal module.

[00014] Figure 2 is a like cross-sectional view showing the method of interconnecting two adjacent modules with the "figure-8 shaped" connector slidably engaged in adjacent grooves.

[00015] Figure 3 is a plan view of a wall assembled of four elongate modules connected together.

[00016] Figure 4 is a sectional view of the wall assembly shown in Figure 3.

[00017] Figures 5, 6 and 7 are cross-sectional views showing various arrangements of two modules joint together to form a corner using a single figure-8 connector.

[00018] Figures 8 and 9 are cross-sectional views showing two identical module joint together with a connector and an angular offset module.

[00019] Figure 10 is an arrangement showing the formation of the corner using interconnecting modules.

[00020] Figures 11 and 12 are cross-sections showing a method or interconnecting modules to form a wall having ribs on one side and on two sides respectively.

[00021] Figures 13 and 14 show methods of connecting the modules to form walls of various thicknesses and configuration.

[00022] Figures 15, 16, 17 and 18 show method of using the modules to form concrete columns of varying cross-sectional configuration.

[00023] Figure 20 shows use of the modules to form a concrete form to pour a ribbed wall.

[00024] Figure 21 shows an elevation view of a concrete form created to form a wall with windows, door and foundation.

[00025] Figure 22 is a cross-sectional view through the form of Figure 21 showing the footing and wall sections.

[00026] Figures 23 is a detailed view of the form work to create a footing with wall for a building.

[00027] Figure 24 is an exploded view of the form work shown in Figure 23.

[00028] Figure 25 is an alternative method of connecting the modules together using external brackets mounted in the outwardly facing grooves together with a wedge inserted in a slot within the brackets to form planar wall portions and corners.

[00029] Figure 26 shows combination of the figure-8 connector and the brackets with wedge inserted in the slot.

[00030] Figure 27 shows the corner module and exploded view with wedge and slot locking mechanism.

[00031] Figure 29 is a perspective view of a single module with end caps at each end, and six holes drilled through side walls to conduct fluid through the module for heating or cooling.

[00032] Further details of the invention and its advantages will be apparent from the detailed description included below.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[00033] Figures 1 through 4 illustrate basic components of the modular assembly, which in the case of Figure 3 has been assembled in a simple planar wall arrangement of four identical modules 1. As best seen in Figure 1 each elongate module 1has a length L (shown in Figure 3) and a uniform generally rectangular cross-section. In order to interconnect with adjacent modules 1, each module 1 has at least one engagement surface 2 and at least one elongate groove 3 extending the length L of the module 1.

[00034] As shown in Figure 2, adjacent modules 1 of the assembly are laterally linked together with their engagement surfaces 2 abutting each other. In the embodiment shown in Figures 1 through 4, a figure-8 shaped connector 4 is mounted in the groove 3 of each adjacent module 1 and expands between the modules 1. Figures 3 and 4 show a simple rectangular wall assembled of four identical modules 1 joined together with three figure-8 connectors 4 mounted in the grooves 3 of each adjacent module 1.

[00035] Figure 1 also shows a solid groove filler strip 5 which is of complimentary shape to the groove 3 and fills in the space in the grooves 3 when the modules 1 are used to form concrete for example so thate the filler 5 prevents inflow of liquid concrete. Figure 1 also shows a reveal module 6 which may be mounted to the primary module 1 in various locations to create architecturally interesting grooves or ribs as desired in a finished concrete surface.

[00036] In the embodiment shown in Figure 1 the module 1 is adapted for manufacture in an aluminium extrusion process. The grooves 3 are disposed in the engagement surfaces 2 however it will understood that grooves 3 and engagement surfaces 3 can be separated if desired and need not be in the same vicinity. The figure-8 connector 4 has two ends 7 each adapted for sliding engagement within the grooves 3.

[00037] In the embodiment shown in Figures 25 through 27, the connectors may comprise a bracket 8 having a first end 9 that is adapt for sliding engagement in the groove 3 and

a second end 10 having a slot opening 11. A wedge 12 is slidably engaged in the slot 11 of cooperating brackets 8 in order to secure adjacent modules 1 together. Also, in the embodiment shown in Figures 25 and 27, the groove filler strip 5 may comprise a thin walled strip as opposed to a solid strip that fills the entire groove 3.

[00038] The embodiment shown in Figure 1 includes grooves 3 which are substantially cylindrical in internal surface and engagement surfaces 2 which are substantially planar. The module 1 illustrated has a rectangular cross-section and planar engagement surfaces 2 with grooves 3 in all four sides of the rectangular cross-section. However, any shape of cross-section with any number of engagement surfaces and grooves may be provided depending on the requirements of the specific application. For ease of understanding and in view of the general use of rectangular forms for building materials a rectangular shaped cross section has been adopted in this description and drawings. When used for concrete formwork, scaffolding, platforms or stages, stairs or temporarily building structures, a simple rectangular shape is often desirable and is easily adapted as a replacement for wood. For example, a substantially planar low bearing surface 13 can be used to contain concrete or provide a platform surface in various structures. Alternatively, the opposite load bearing surface 14 is provided with a trapezoidal cross section channel 15 which can be used to form ribs in formed concrete floors or floor surfaces as explained in detail below.

[00039] Further, in the embodiments shown in Figures 8 and 9, modules 1 can be connected together with an

elongated figure-8 connector 4 together with an angular offset module 16 having two engagement surfaces that are disposed at an angle 'α' relative to each other.

[00040] Figures 5, 6 and 7 show two modules 1 connected together with a figure-8 connector 4 in various different configurations to provide flat surfaces or ribbed surfaces on inside and outside corners of a concrete form for example.

[00041] Likewise, Figures 10, 11, 12, 13 and 14 show various configurations of concrete forms to create corners, ribs and different wall thickness for concrete form work utilizing identical modules 1 and connectors in accordance with the invention.

[00042] Figures 15, 16, 17 and 18 also illustrate various configurations of identical modules 1 with connectors to form columns of poured concrete in various shapes and cross-sectional areas. The modularity of the form work provides the advantage that various shapes and sizes can be created using identical re-useable modular components.

[00043] Figure 20 shows an exploded view of formwork removed from the finished work showing the means by which a completely planar concrete wall surface and alternatively an opposite ridged wall surface can be formed. It will be understood by those skilled in the art that floor surfaces wall and other structural components may be formed in a like manner with or without ridges and with various thicknesses as desired.

[00044] Figures 21 and 22 show use of the modules 1 to pour the concrete wall of the building for example with a door opening 17 and window opening 18. The bottom portion of the form may have a footing portion of larger width.

[00045] Figures 23 and 24 show the example of forming the wall of concrete having a footing 19 where modules 1 are used to form a footing 19 as well as a wall portion 20. Angle iron brackets 21 supporting sections of modules 1 of various lengths can be adapted to form wall 20 and footings 19 of various shapes and configurations.

[00046] Figure 29 is a perspective view of a single module 1 with end caps 22 at each end, and six holes 23 drilled through side walls to conduct fluid through threaded fittings 24 and hoses 25 for heating or cooling the module 1. When the modules 1 are used to construct concrete formwork for example, heating of concrete in the winter or cooling during summer can be carried out by circulating hot or cold liquid with pumps through the hoses 25 and chambers created in the module 1 between end caps 22. The same arrangement may be used to inject liquid foam that later cures for insulating or structural reinforcing functions.

[00047] Although the above description relates to a specific preferred embodiment as presently contemplated by the inventor, it will be understood that the invention in its broad aspect includes mechanical and functional equivalents of the elements described herein.